

Investment in energy efficiency at the University of Warwick



The University of Warwick's energy management strategy is characterised by consistent investment in improved plant and equipment via:

- energy design standards applied to all new and refurbished buildings
- an index-linked, ring-fenced annual budget for retrofit energy projects
- use of alternative financing options
- direct funding of projects by non-academic departments



ENERGY EFFICIENCY

BEST PRACTICE
PROGRAMME

INTRODUCTION

Introduction

The University of Warwick occupies a 225-hectare landscaped campus site three miles south of Coventry. The University has approximately 15 000 students, including 8000 undergraduates. Its buildings range in age from the mid-1960s up to the present day, and consume around £2.25 million worth of energy and water each year.

The University is committed to effective energy management and has adopted a formal energy policy which supports ongoing targeted investment as a means of improving its energy efficiency.

Energy design standards have been developed for all new and refurbished buildings, as this represents the most cost-effective route for investing in energy efficient plant and equipment.

A dedicated 'ring-fenced' annual budget of £50 000 has also been set to finance retrofit energy efficiency projects and its value has been protected by index linking.

To qualify for funding from this budget, a scheme must provide a payback in three years or less. The budget can be transferred into the next financial year if not completely spent, ie the budget is increased in the next financial year.

In appropriate cases alternative financing methods have been used and significant investment has also been channelled into sub-metering which has enabled energy usage to be directly recharged to certain University departments. This has increased their commitment to managing their own energy usage and encouraged their direct investment in energy efficiency measures.

Increases in student numbers and building stock have made it difficult for the resulting financial benefits to be quantified. Recently applied normalisation techniques have shown, however, that since 1993/94 energy consumption has been reduced by 5.3% (after correction for weather, new buildings and increased IT equipment), with energy cost savings worth over £137 000 per year.

Consistent investment also keeps building services up to date and reliable. Modern facilities boost the University's appeal to both students and those organisations that use its conference resources. This, in turn, brings additional income to the University.

Investment in new and refurbished buildings (energy design standards)

A key element of the University of Warwick's energy management strategy is to ensure that energy efficient features are incorporated into all new and refurbished buildings. This represents the most cost-effective way of improving the performance of the buildings, and the majority of the University's energy efficiency investment has been made in this way.

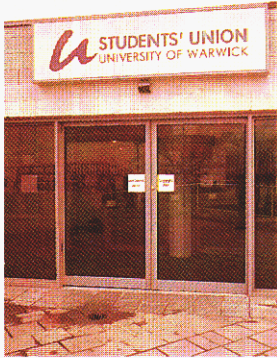
To ensure that no opportunities are missed, the Estates Department provides an energy design standard for all new and refurbished building projects. Use of the standard is supported by the University's energy policy. The basic standard comprises:

- building fabric to exceed Building Regulations' thermal performance requirements by 10%
- high frequency fluorescent lighting
- automatic lighting control systems
- pulsed output energy and water sub-meters.



Aerial view of the University of Warwick

BENEFITS



*Students' Union
automatic doors*

So far budgets have been devolved only to non-academic departments (such as residences, catering and conference), but the University is encouraged by the results and intends to extend the procedures to academic departments as well. The first of these will be the major science departments which will be recharged initially for their water usage.

Interest among user departments is further encouraged by an Estates Department energy conservation Web site, which can be found at [http: //energy-conservation.warwick.ac.uk/](http://energy-conservation.warwick.ac.uk/) .

Making a Corporate Commitment

The University of Warwick is committed to effective energy management. This has been demonstrated publicly by the University becoming signatory to the Department of Environment's 'Making a Corporate Commitment' campaign on energy management.

This commits the University to:

- publish a corporate policy
- operate an energy management responsibility structure
- increase awareness of energy efficiency among its staff
- hold regular reviews
- set performance improvement targets
- monitor and evaluate performance levels
- report performance changes and improvements.

This represents good practice and is in line with the University's current energy management activities.

Benefits

The measures introduced at Warwick have produced a saving of 5.3% in energy consumption since 1993/94, resulting in energy cost savings of over £137 000 annually.

Quantifying the financial benefits of the University's investment in energy efficiency has been difficult, but the Estates Department has adopted normalisation procedures that enable this to be done.

The results amply justify the University's sustained investment policy which has kept building services up-to-date and reliable. The well-maintained modern resources have enhanced Warwick's appeal both to students and to those organisations which use its conference facilities. This, in turn, has brought additional income to the University.



The Warwick Business School

ALTERNATIVE FINANCING OPTIONS

Alternative financing options

In addition to using funds from its energy efficiency works budget, the Estates Department has also been keen to explore alternative methods of financing specific energy projects, such as the CHP system installed in the University's Sports Centre.

Small-scale CHP may still be viewed by some Universities' governing bodies as speculative, long-payback technology, and it is certainly true that the implications of the maintenance necessary to ensure long-term reliability need to be considered carefully in any application. One method of eliminating any technical or financial risk is to enter into a Discounted Energy Purchase (DEP) arrangement with the system's installer, and this option was chosen by the University of Warwick.

The DEP agreement is for ten years and under the terms of the agreement the CHP system was installed (by the manufacturer) free of charge. Gas fuel for the unit is provided by the University which then gets free heat from it and buys electricity from the installer at a discounted price (less than half the standard tariff rates). The income from these electricity sales enables the installer to finance the installation and provide ongoing maintenance.

Having gained confidence in the viability of small-scale CHP systems in a university environment, it is likely that in the future the University would purchase and maintain the plant itself in order to gain the maximum financial benefit.

Encouraging investment by user departments

While it is comparatively straightforward for universities to control central services such as boilerplant and air-conditioning systems effectively, many are frustrated when they attempt to motivate individual members of staff to use energy more effectively in their workplace. The University of Warwick tackled this problem by investing £50 000 in electricity, gas, oil and water sub-meters (with an associated computerised data-logging/reporting system), and now uses them to support the recharging of energy costs to individual non-academic departments.

Departments with devolved energy budgets are recharged quarterly by the Estates Department for their energy usage and, most importantly, are responsible for funding their own energy efficiency projects.

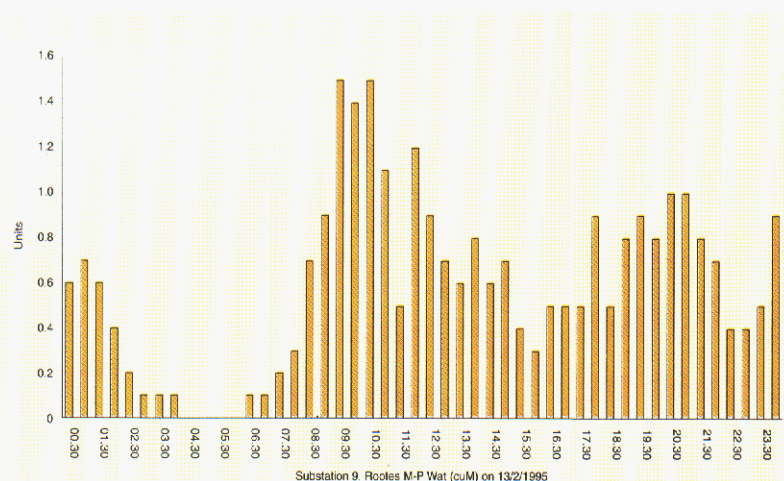
The change in attitude to energy efficiency engendered by the devolution of budgets is well illustrated by the scope of projects implemented by the user departments. These have ranged from simple to complex measures and have included:

- the installation of automatic draught lobby doors to the Students' Union building
- the installation of a CHP unit to the main Conference Area.



*Draught lobby of
Students' Union building*

Recharges are based on each department's metered consumption multiplied by the average prices paid by the University for electricity, gas and water. The use of electronically read sub-meters offers the opportunity to apply variable 'time of day' charges to each department (in line with the University's electricity supply contract), and it is hoped to move to this more accurate method of recharging in the future.

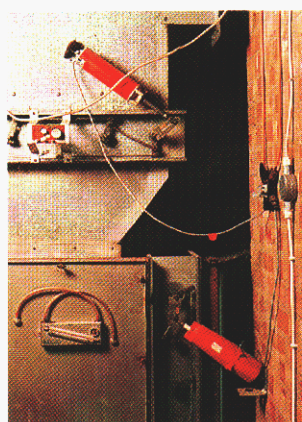


Example of hourly water usage data provided by sub-metering

RING-FENCED BUDGET



Low-loss plate heat exchangers



Variable ventilation control damper

The automatic lighting controls have been particularly effective and include daylight sensors and passive infrared (PIR) presence detectors. These have been applied successfully both in academic and residential buildings.

Upgrading the thermal properties of the building stock has proved more challenging, however, given the construction of many of the University's original buildings. Measures have included the widespread introduction of automatic door closers, draughtstripping and roof insulation. The last has been applied in conjunction with other flat roof refurbishment works.

In more energy intensive buildings, the energy design standard has been expanded to encompass other technologies. Typical of such a project was the refurbishment of the Sports Centre, where work included:

- the installation of a combined heat and power (CHP) system using the swimming pool as its heat sink
- the use of high efficiency, fully modulating, atmospheric gas boilers
- the replacement of conventional calorifiers with rapid response, low loss, plate heat exchangers
- the modification of the swimming pool ventilation system to provide variable recirculation heat recovery, based on airborne chlorine levels
- the addition of inverter-based variable speed drives to ventilation fans.

Ring-fenced budget for energy efficiency projects

Notwithstanding its concentration on new and refurbished buildings, the University of Warwick has also undertaken a wide range of retrofit energy efficiency projects. Since the beginning of this programme the University has invested nearly £300 000 in this way.

To ensure the ongoing availability of funds for retrofit energy projects, a dedicated annual energy efficiency works budget was created, and this currently stands at about £50 000 per year (2.5% of annual energy costs). To emphasise its

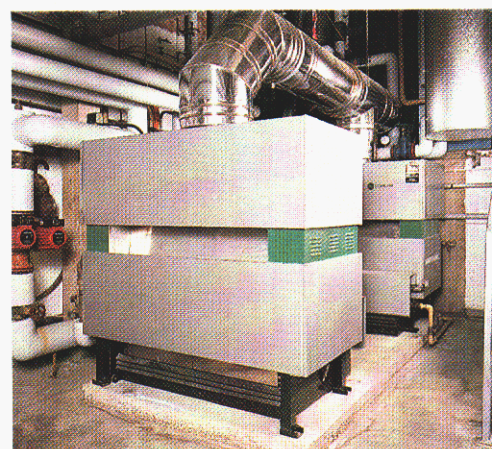
importance, the budget is 'ring-fenced' to prevent its expenditure on non-energy projects. It is also index linked to ensure that its value is not diminished by inflation. The budget is allocated each year, irrespective of whether or not any specific projects have been identified at that time, and provides the Works Department with the flexibility to undertake ad hoc energy efficiency works at short notice.

Most investment has concentrated on reducing gas and oil usage by improvements to the University's space heating and domestic hot water systems.

In the past, the greater part of the site was heated by a high temperature hot water district heating network, with calorifiers located in each major building. While the core of the district heating system has been retained, many peripheral areas of the site (especially those with unusual or extended operating hours), have now been disconnected from the system and provided with their own local gas-fired boiler plant.

This phased, £60 000 investment has enabled the district heating network to become more compact and its operating hours to be reduced.

To support the new boilers, over £100 000 has gradually been invested in improved heating controls. These have ranged from simple thermostatic radiator valves through to a comprehensive Building Energy Management System, which was further upgraded in 1996.



New modulating boilers

FURTHER INFORMATION

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Companies and public sector organisations may join over 1600 others in the Department of the Environment's Making a Corporate Commitment (MACC) campaign to achieve financial and environmental benefits from responsible energy management. On joining the campaign, a senior board member signs a Declaration of Commitment which covers a number of elements, eg publishing a corporate policy, appointing an energy manager, setting performance targets and increasing energy awareness among staff. Further information is available from the Department of the Environment, telephone 0171 276 4613 (from June '97 0171 890 6616).

DOE ENERGY EFFICIENCY BEST PRACTICE PROGRAMME DOCUMENTS

This Case Study is one of four which focus on energy saving techniques in the further and higher education sector.

Good Practice Case Studies

- 333 Energy management practices in further education, Southwark College of Further Education – a low cost pragmatic approach
- 334 The benefits of including energy efficiency early in the design stage – Anglia Polytechnic University
- 336 Energy efficiency in further and higher education – Monitoring and targeting, University of Wales, Cardiff

Good Practice Guide

- 207 Cost-effective low energy buildings in further and higher education

These and other documents from the Department of the Environment's Energy Efficiency Best Practice programme are available from BRECSU Enquiries Bureau. Contact details are given below.

The Department of the Environment's Energy Efficiency Best Practice programme provides impartial, authoritative information on energy efficiency techniques and technologies in industry and buildings. This information is disseminated through publications, videos and software, together with seminars, workshops and other events. Publications within the Best Practice programme are shown opposite.

For further information on:

Buildings-related projects contact:
Enquiries Bureau

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For industrial topics contact:
Energy Efficiency Enquiries Bureau

ETSU

Harwell, Oxfordshire
OX11 0RA
Tel 01235 436747
Fax 01235 433066

Energy Consumption Guides: compare energy use in specific processes, operations, plant and building types.

Good Practice: promotes proven energy efficient techniques through Guides and Case Studies.

New Practice: monitors first commercial applications of new energy efficiency measures.

Future Practice: reports on joint R&D ventures into new energy efficiency measures.

General Information: describes concepts and approaches yet to be fully established as good practice.

Fuel Efficiency Booklets: give detailed information on specific technologies and techniques.

Introduction to Energy Efficiency: helps new energy managers understand the use and costs of heating, lighting etc.